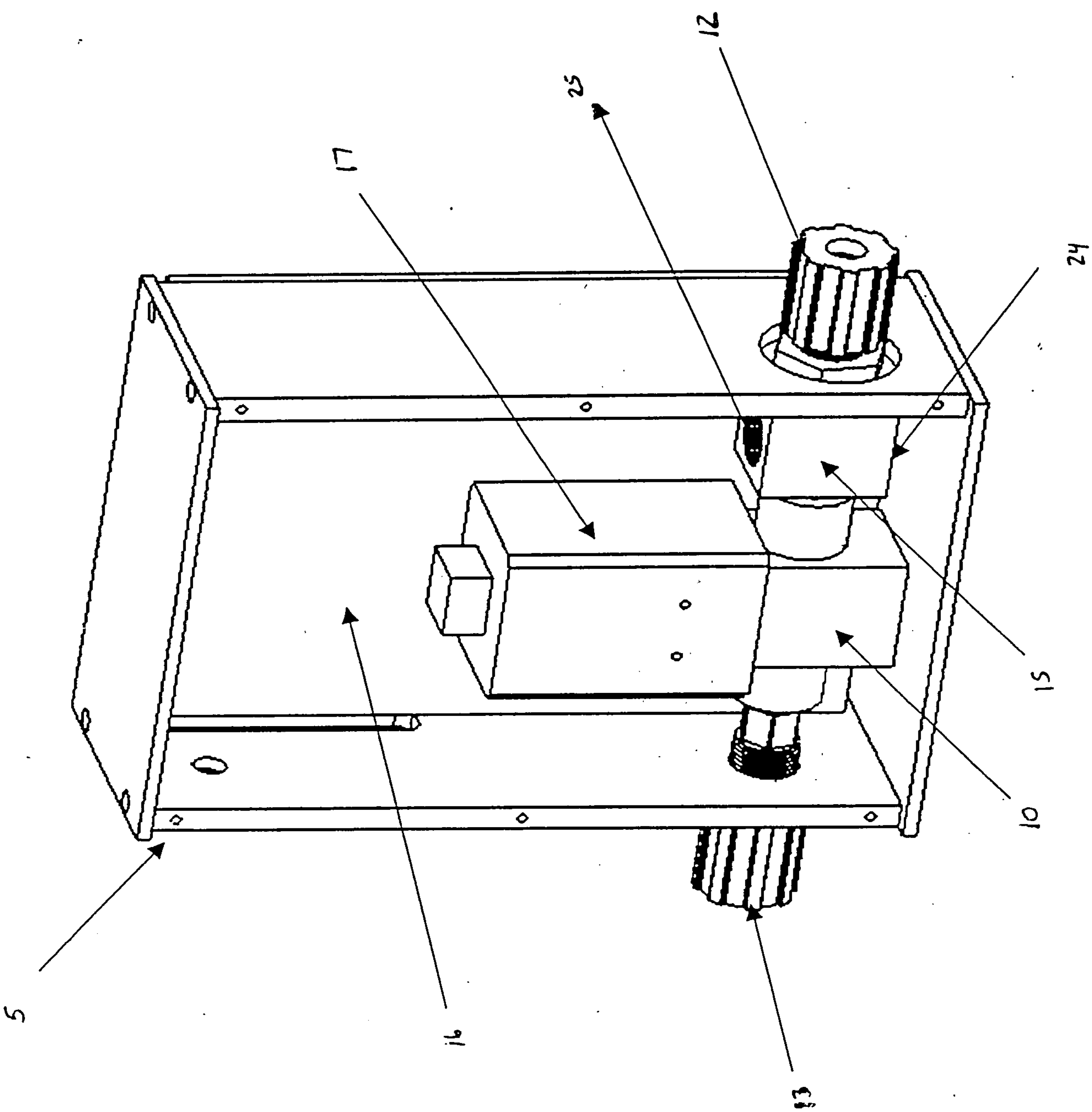


Fig. 1

Concentric venturi

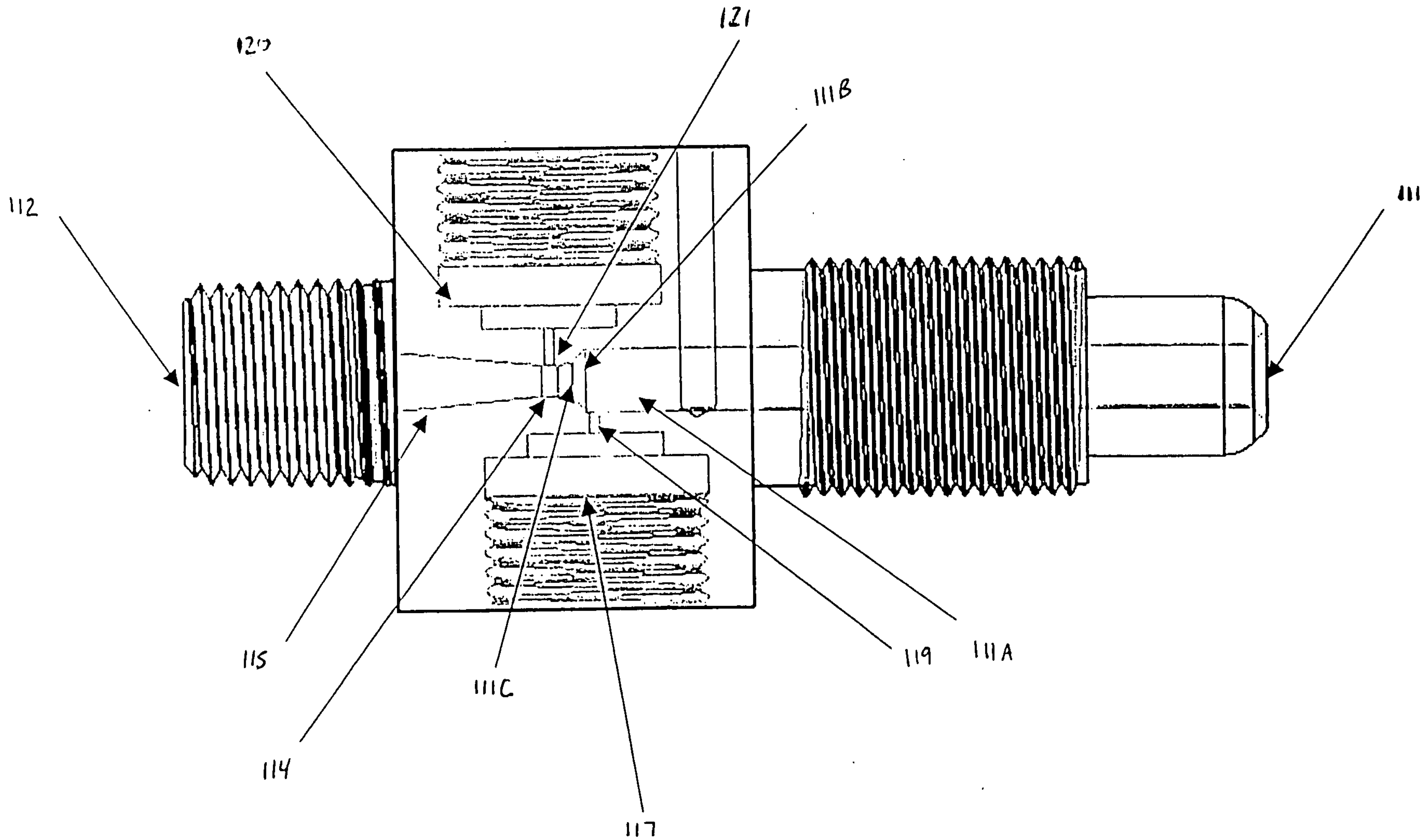


FIG. 2

10/521697

10/521697

Concentric venturi

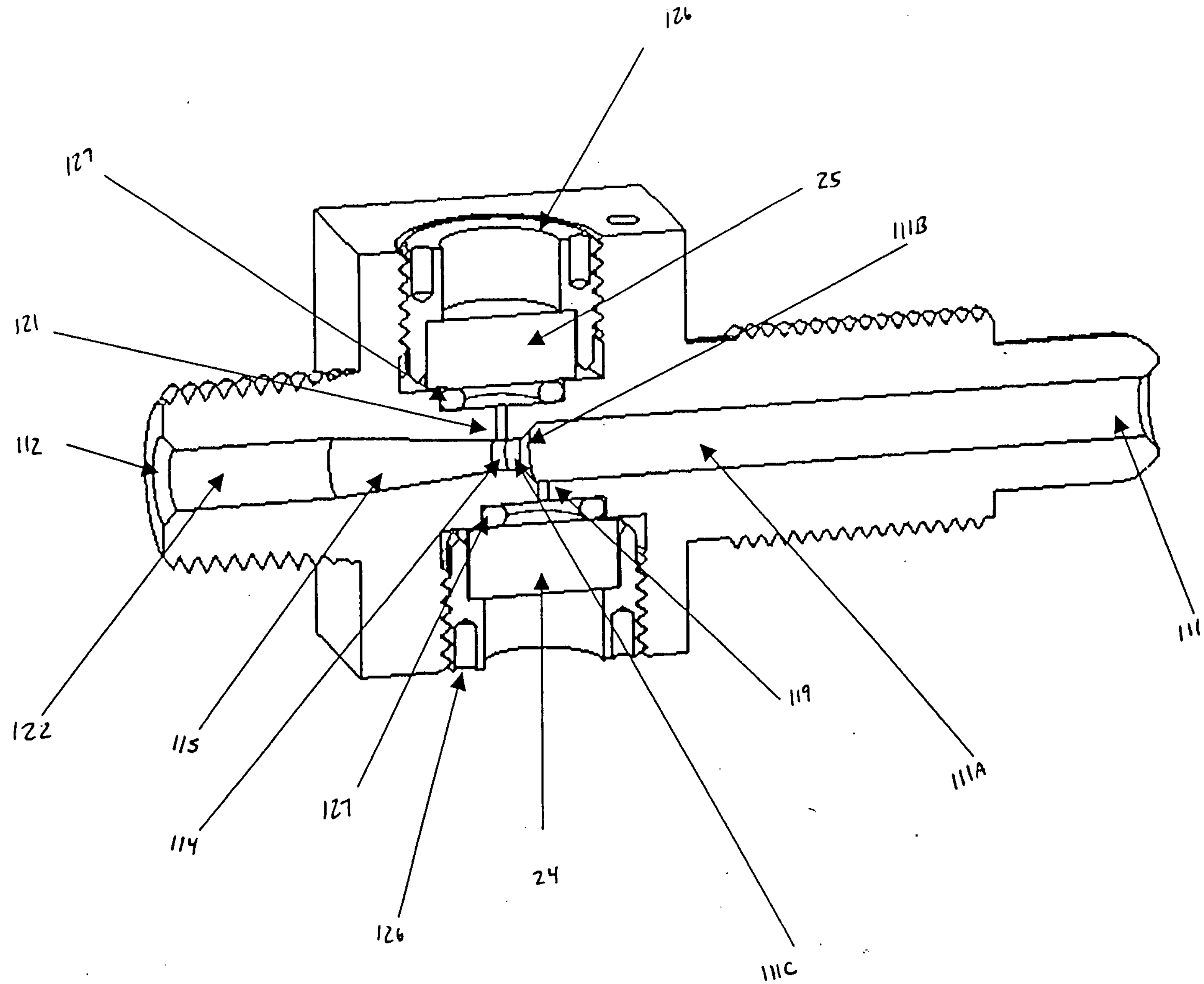
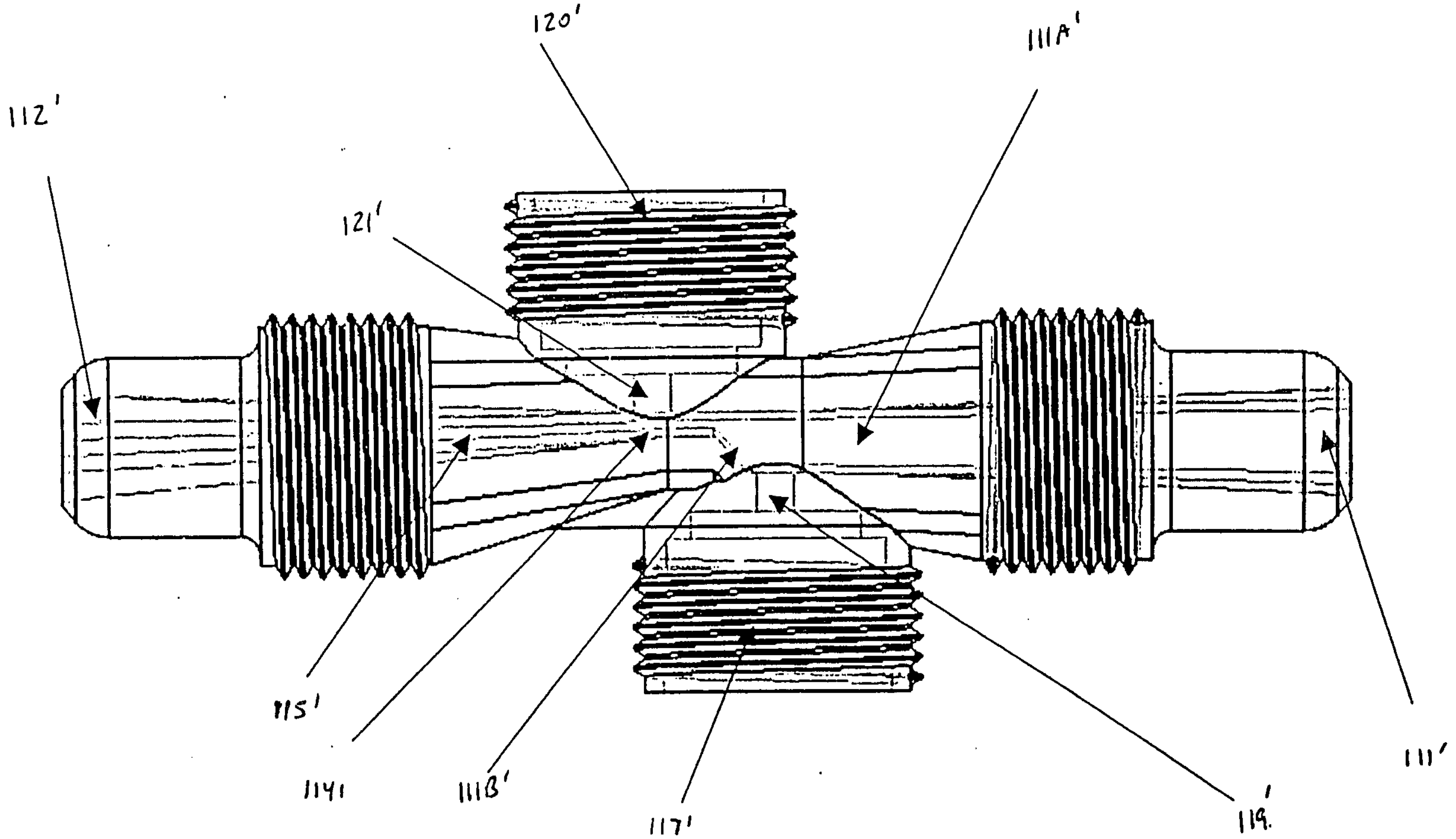


FIG. 3

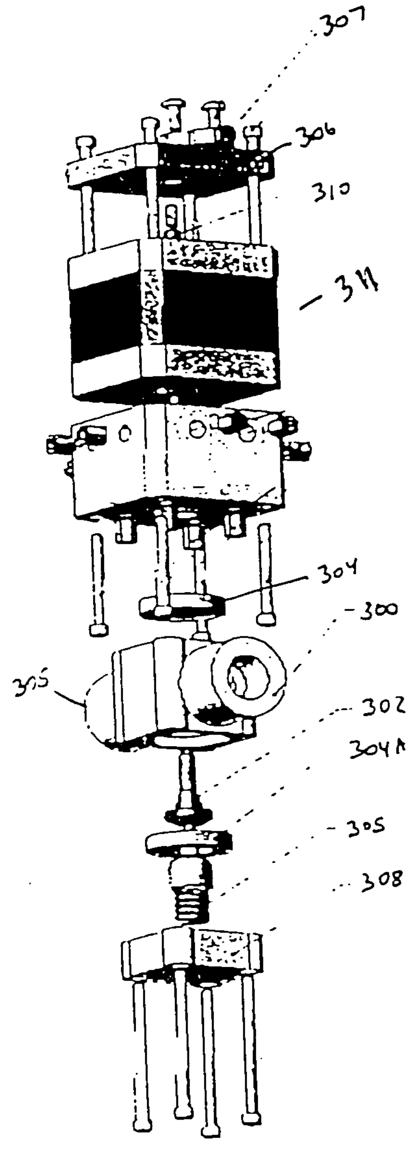
10/521697



Eccentric flat channel venturi

FIG. 4

FIG. 5



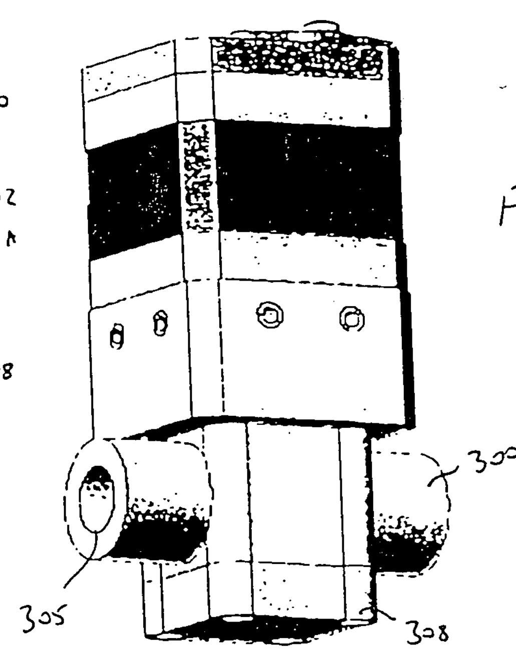


FIG. 6

10/521697

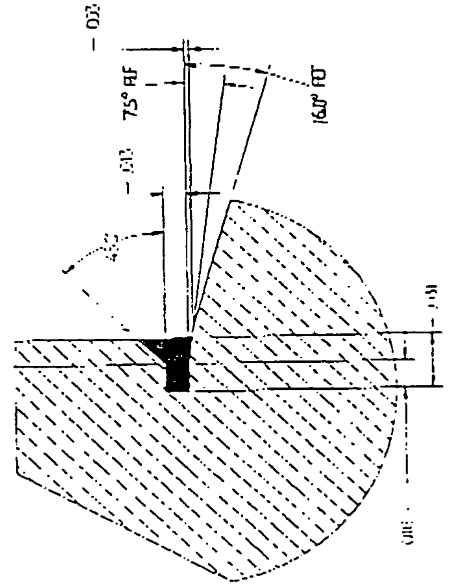


FIG. 7A

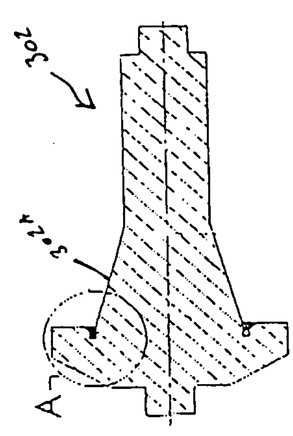


FIG. 7

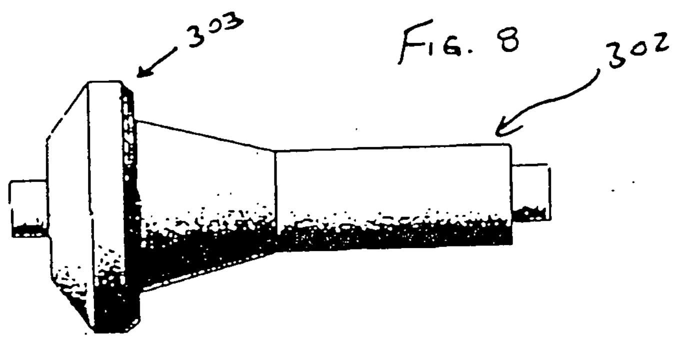


FIG. 8

Fig. 9

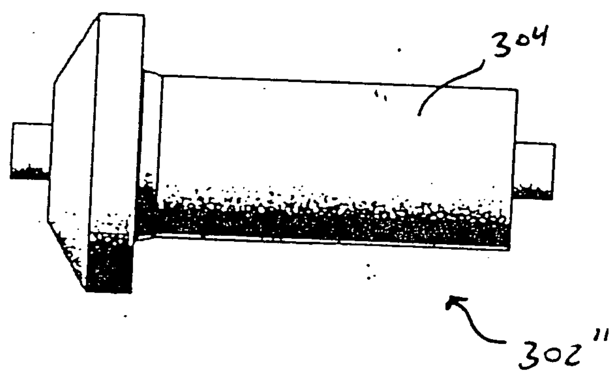
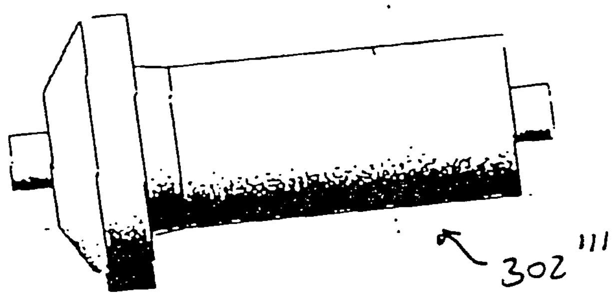


FIG. 10



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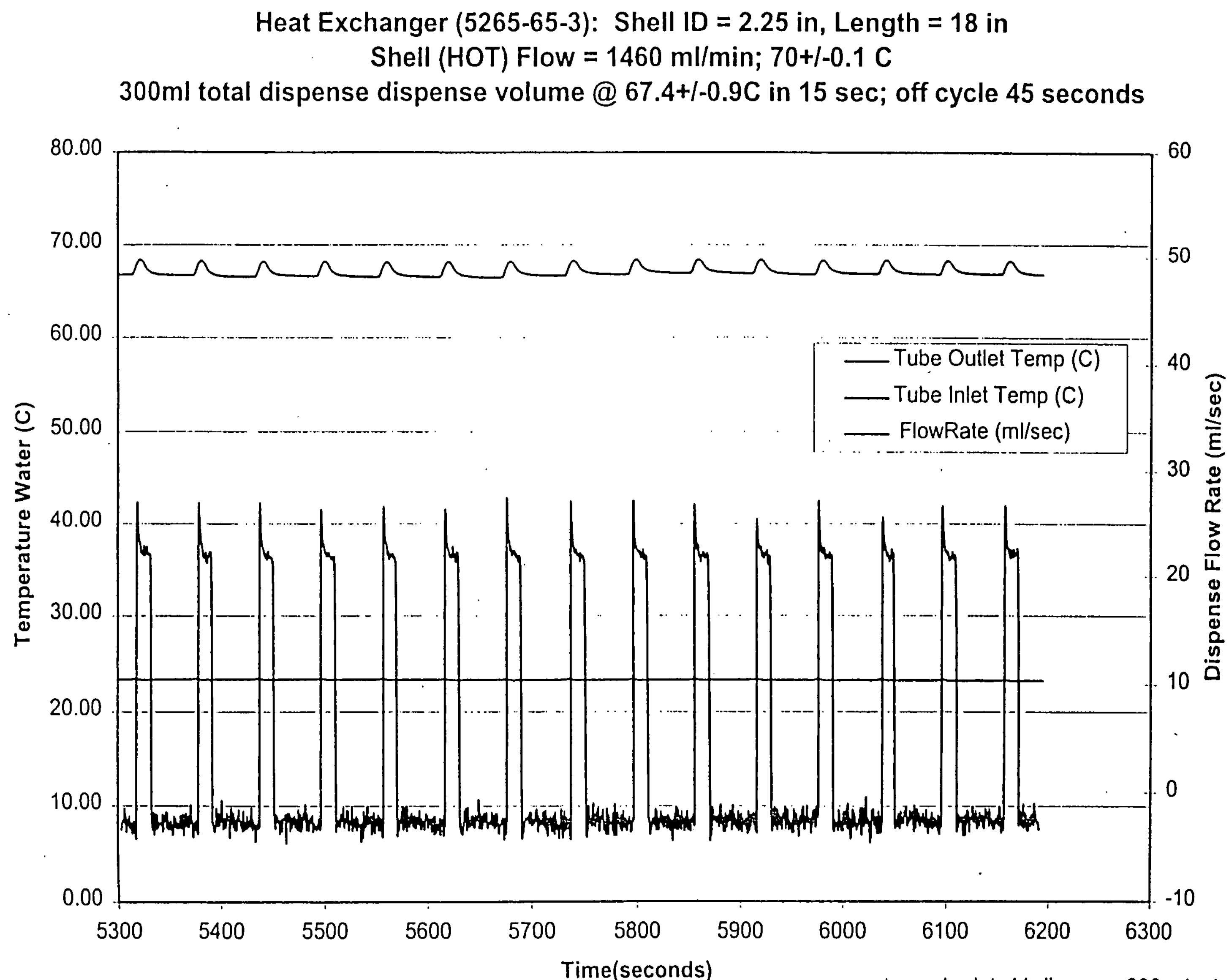
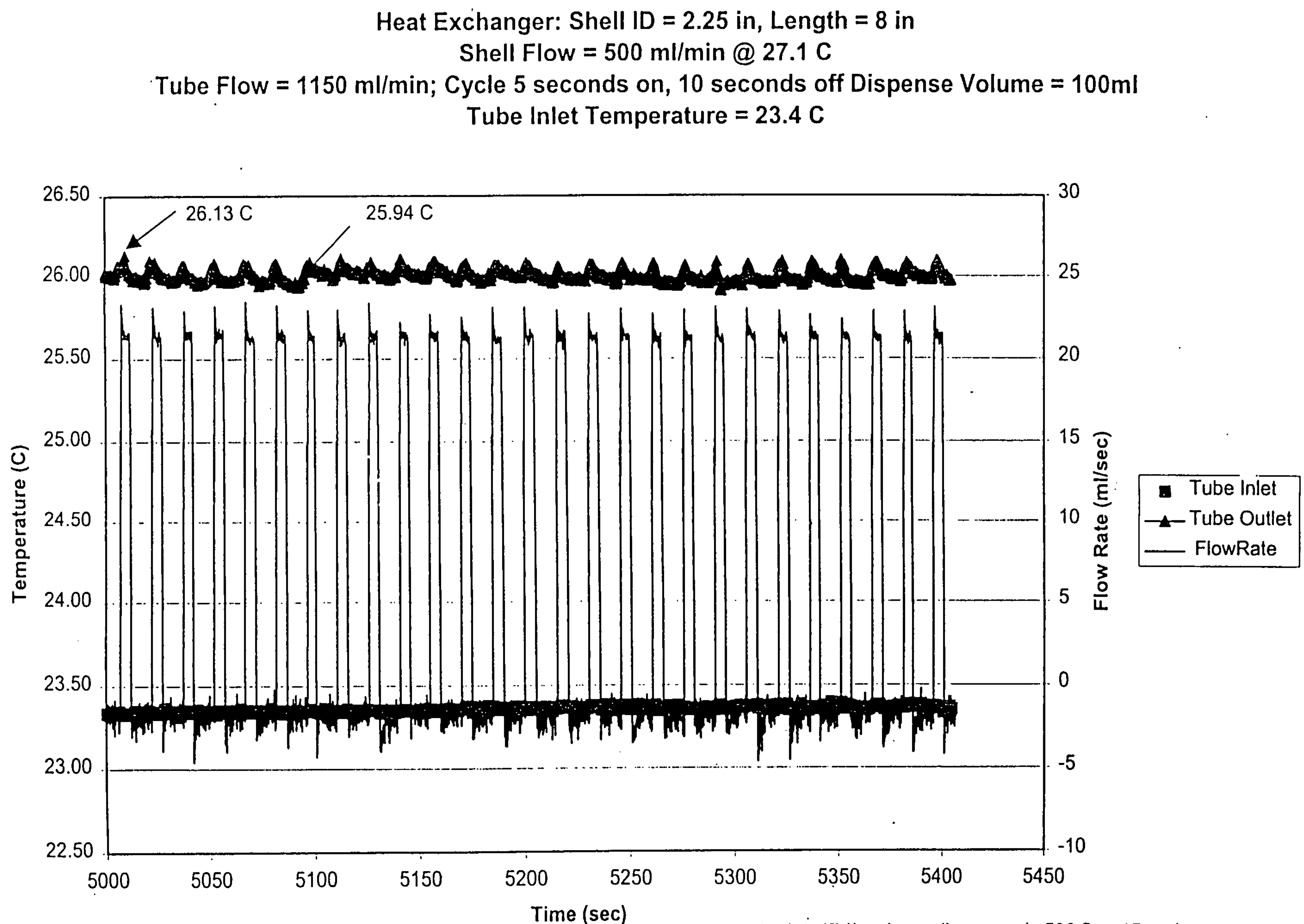


hedata44-dispense 300 ml min 18 inch unit.xls

FIGURE 11

10/521697



hedata47-developer dispense.xls 500 flow 15 cycle

FIGURE 12

10/521697

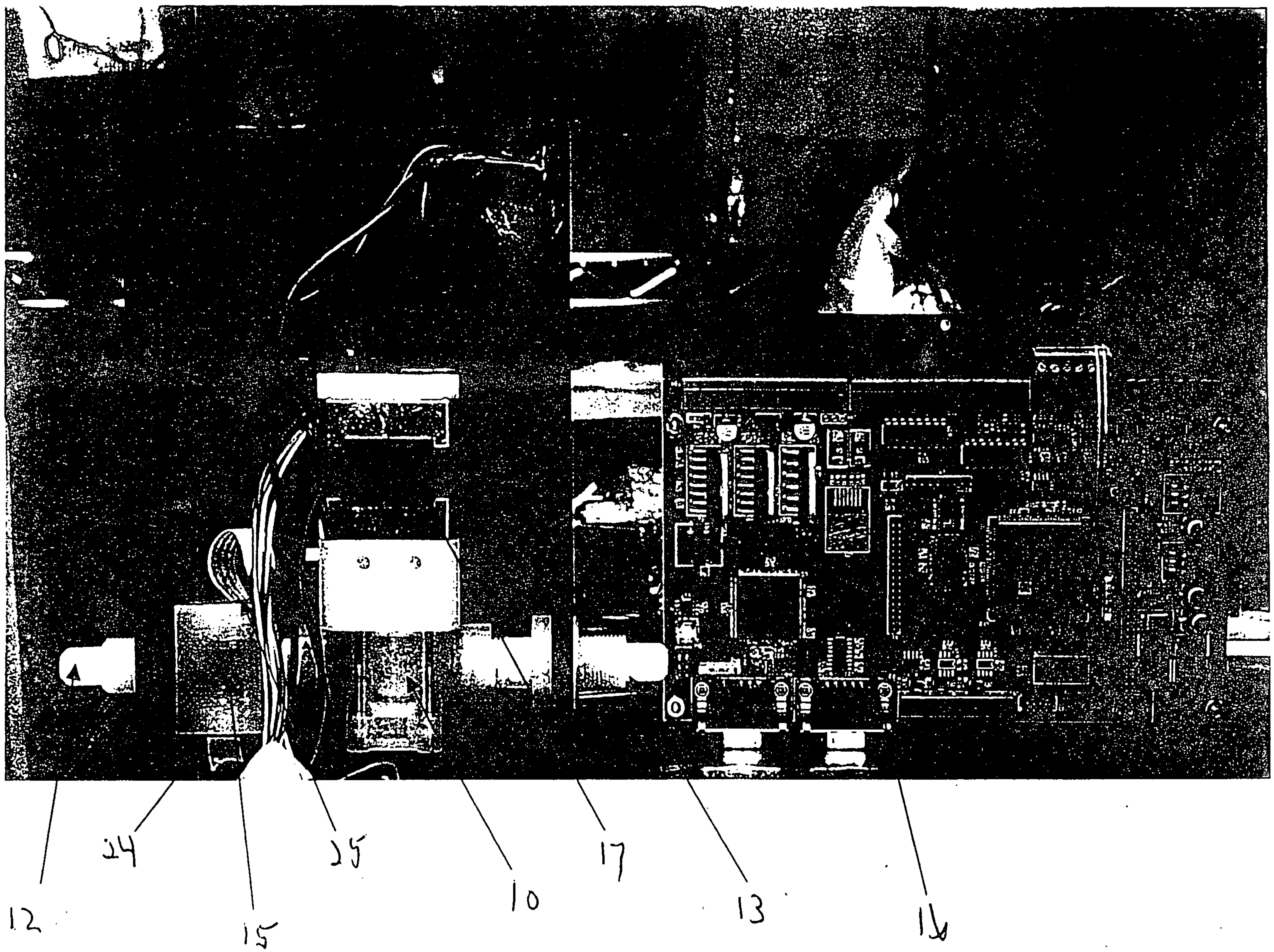


Figure 13

10/521697

Flute #1
0711flute1flow.xls

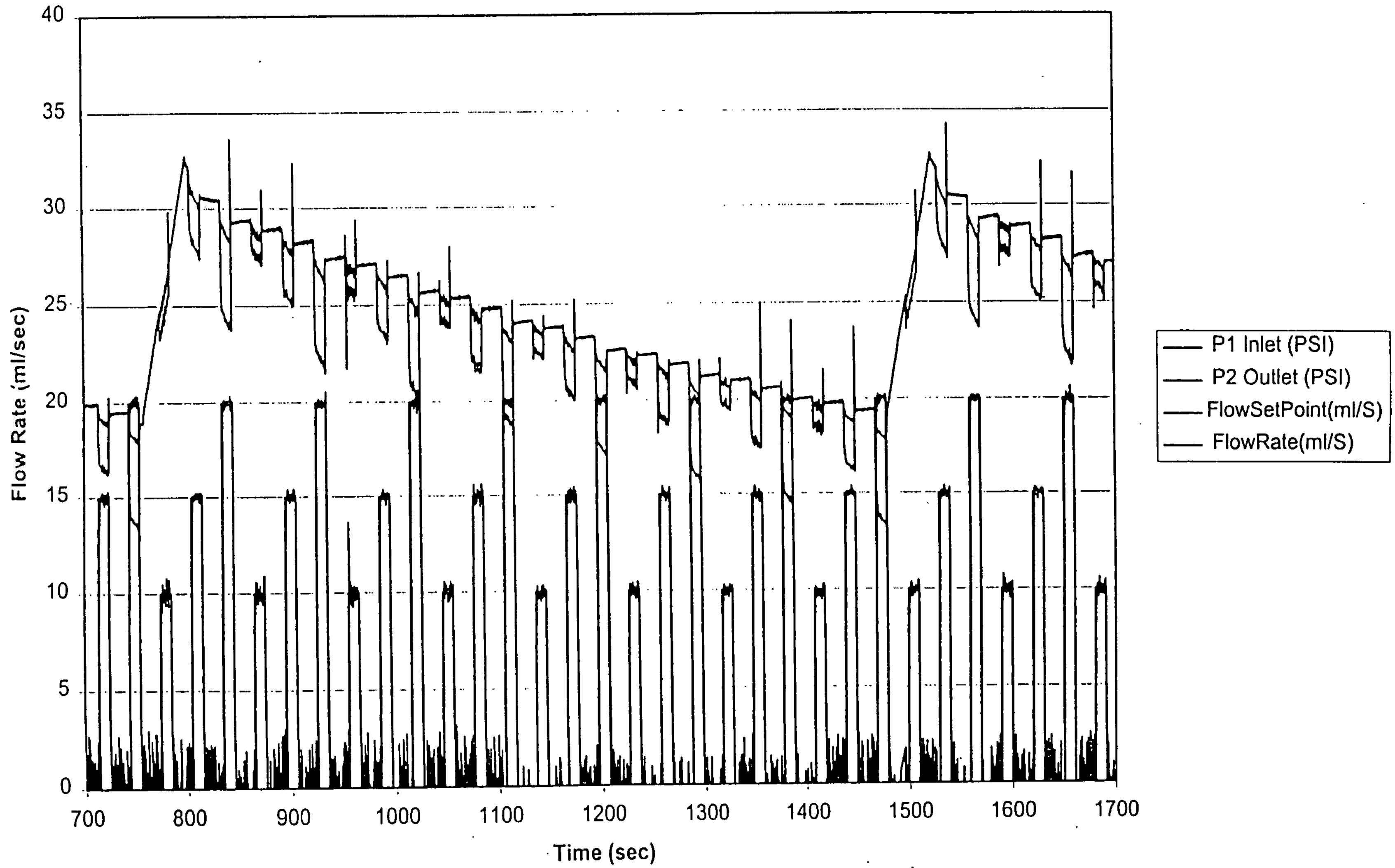


FIGURE 14

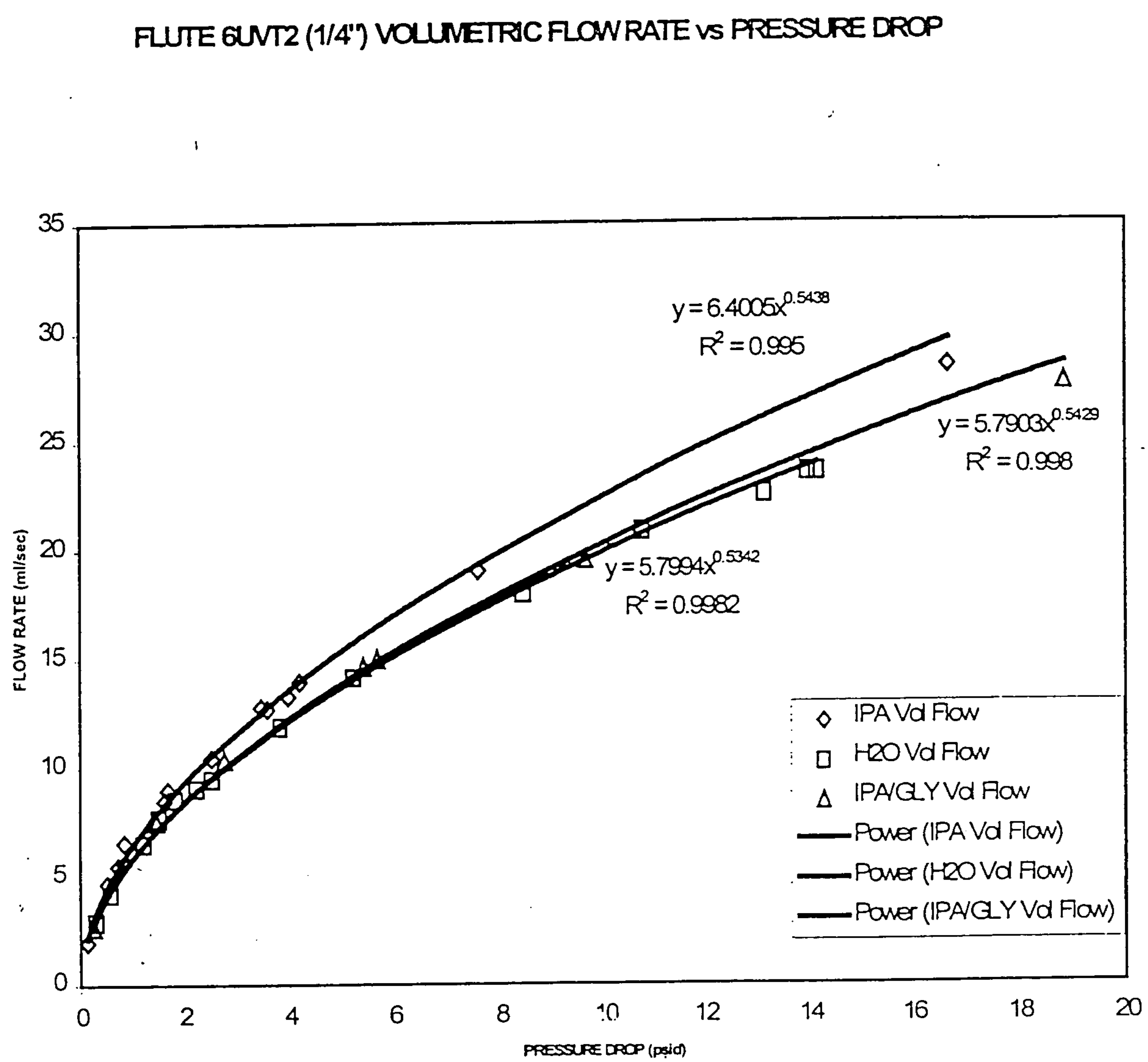

FLUTE 6UVT2 (1/4") VOLUMETRIC FLOW RATE vs PRESSURE DROP
y = 6.4005x^0.5438
R^2 = 0.995
y = 5.7903x^0.5429
R^2 = 0.998
y = 5.7994x^0.5342
R^2 = 0.9982
IPA Vol Flow
H2O Vol Flow
IPA/GLY Vol Flow
Power (IPA Vol Flow)
Power (H2O Vol Flow)
Power (IPA/GLY Vol Flow)
FLOW RATE (ml/sec)
PRESSURE DROP (psid)
0
5
10
15
20
25
30
35
0
2
4
6
8
10
12
14
16
18
20

Figure 15

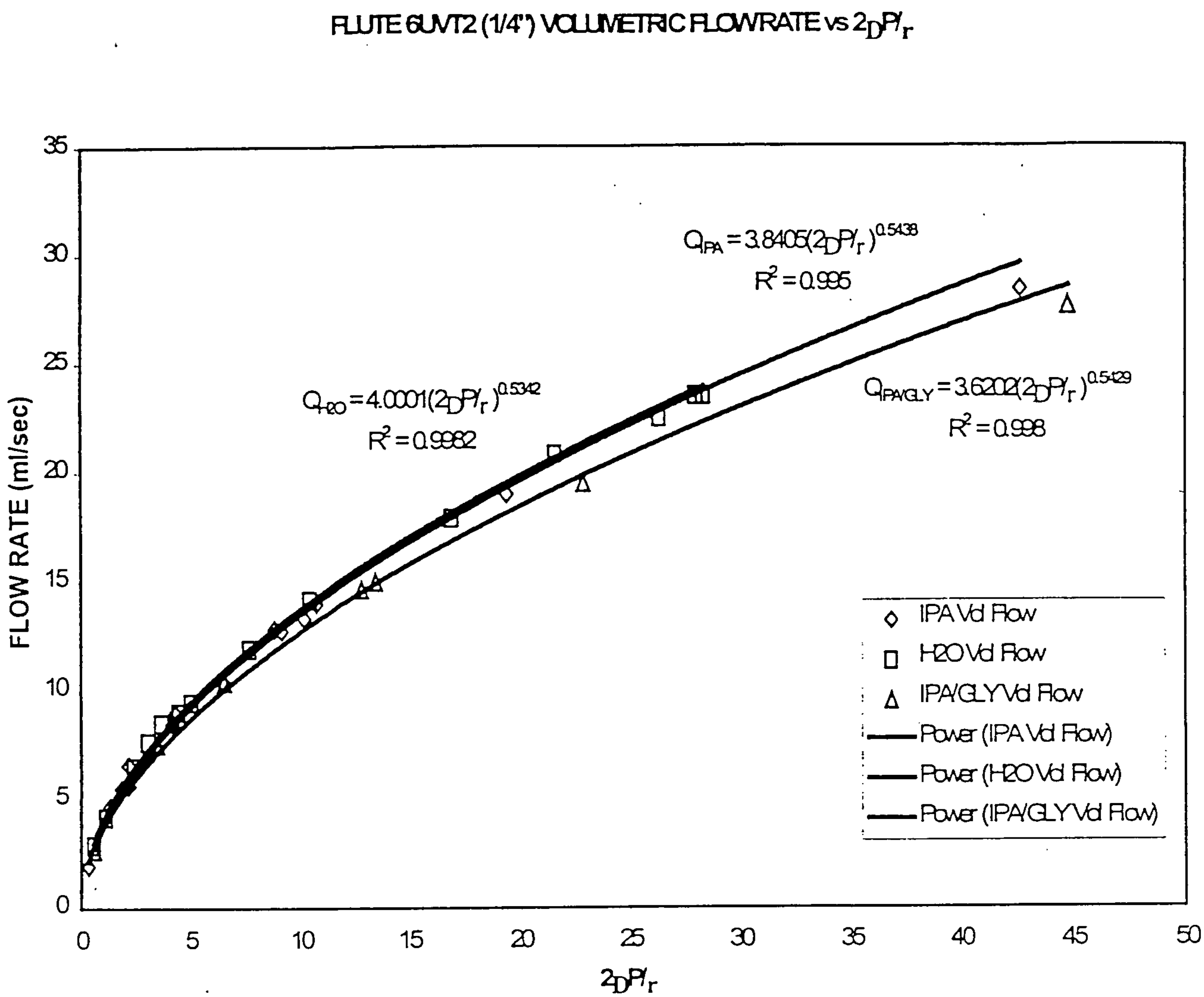

FLUTE 6UVT2 (1/4") VOLUMETRIC FLOWRATE vs 2DP/r
FLOW RATE (ml/sec)
2DP/r
Q_IPA = 3.8405(2DP/r)^0.5438
R² = 0.995
Q_H2O = 4.0001(2DP/r)^0.5342
R² = 0.9982
Q_IPA/GLY = 3.6202(2DP/r)^0.5429
R² = 0.998
IPA Vol Flow
H2O Vol Flow
IPA/GLY Vol Flow
Power (IPA Vol Flow)
Power (H2O Vol Flow)
Power (IPA/GLY Vol Flow)
0
5
10
15
20
25
30
35
40
45
50

Figure 16

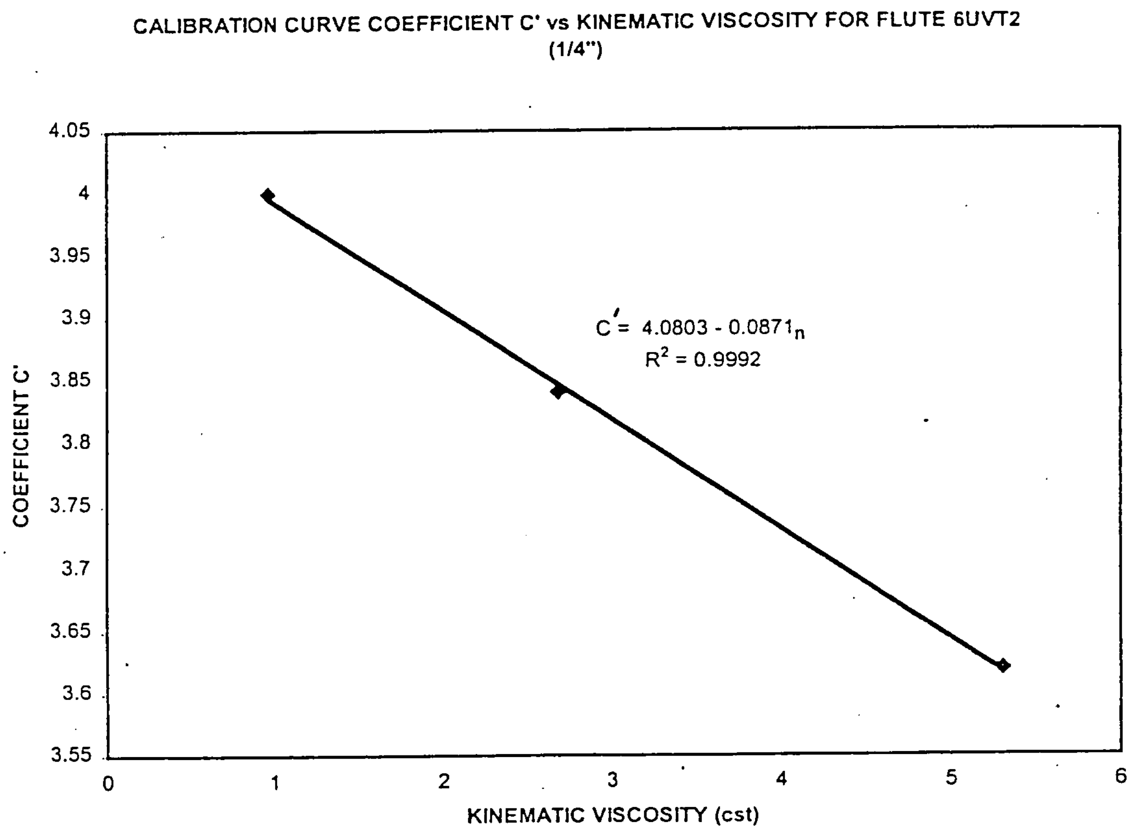
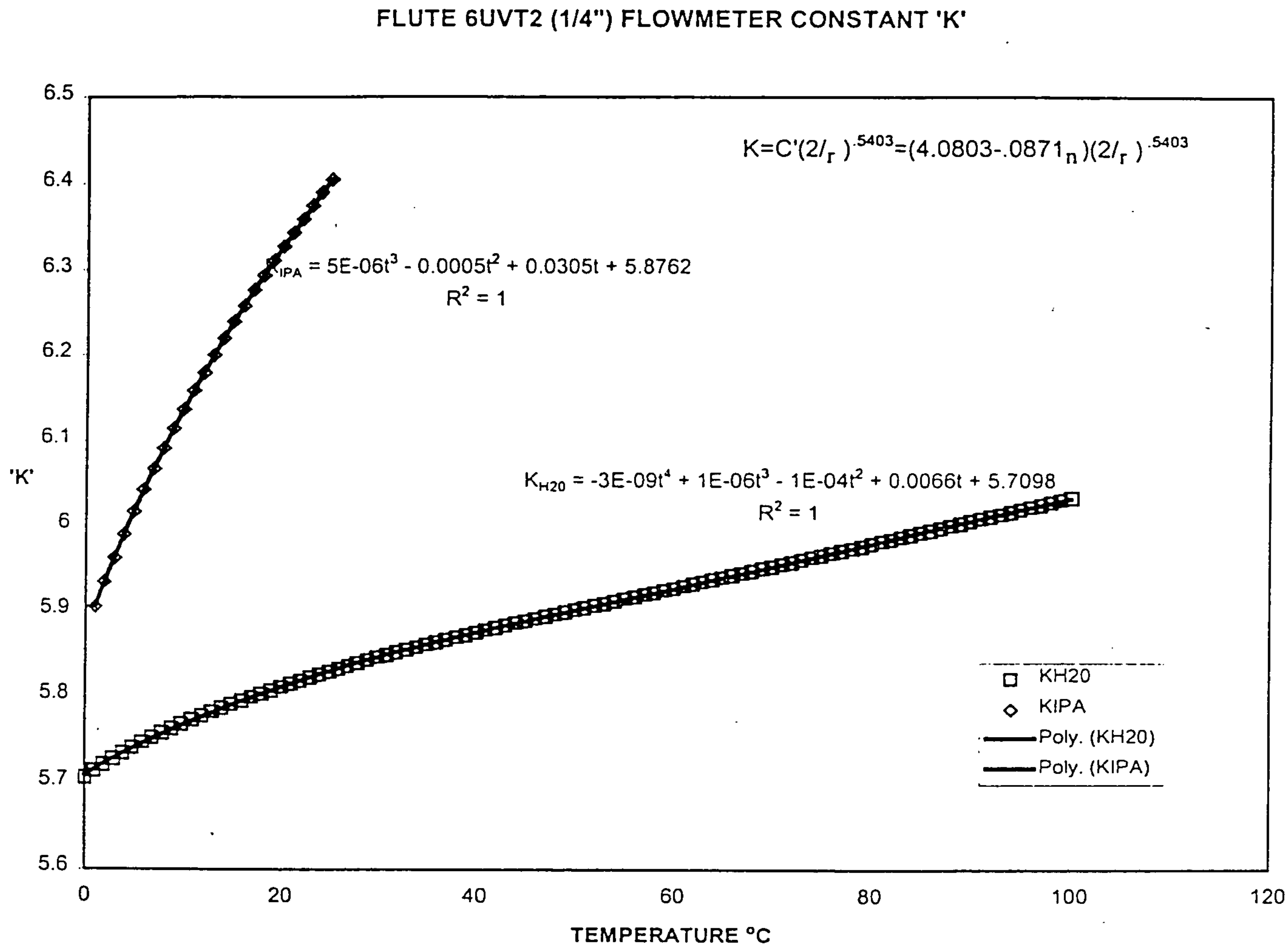

CALIBRATION CURVE COEFFICIENT C' vs KINEMATIC VISCOSITY FOR FLUTE 6UVT2 (1/4")
C' = 4.0803 - 0.0871n
R2 = 0.9992
COEFFICIENT C'
KINEMATIC VISCOSITY (cst)
4.05
4
3.95
3.9
3.85
3.8
3.75
3.7
3.65
3.6
3.55
0
1
2
3
4
5
6

Figure 17



FLUTE 6UVT2 (1/4") FLOWMETER CONSTANT 'K'
K=C'(2/r)^.5403=(4.0803-.0871n)(2/r)^.5403
KIPA = 5E-06t^3 - 0.0005t^2 + 0.0305t + 5.8762
R^2 = 1
KH20 = -3E-09t^4 + 1E-06t^3 - 1E-04t^2 + 0.0066t + 5.7098
R^2 = 1
'K'
6.5
6.4
6.3
6.2
6.1
6
5.9
5.8
5.7
5.6
0
20
40
60
80
100
120
TEMPERATURE °C
KH20
KIPA
Poly. (KH20)
Poly. (KIPA)

Figure 18

10/521697

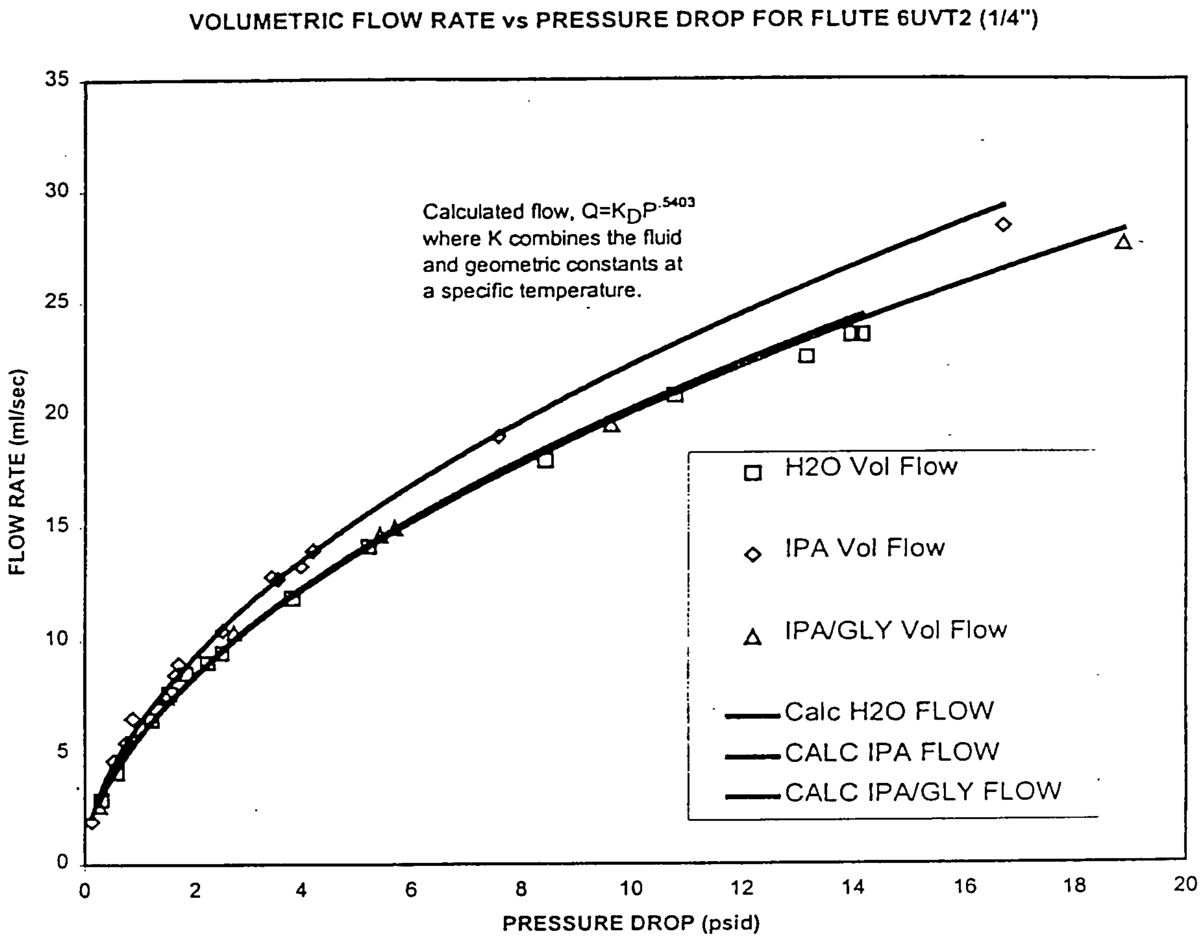


Figure 19

10/521697

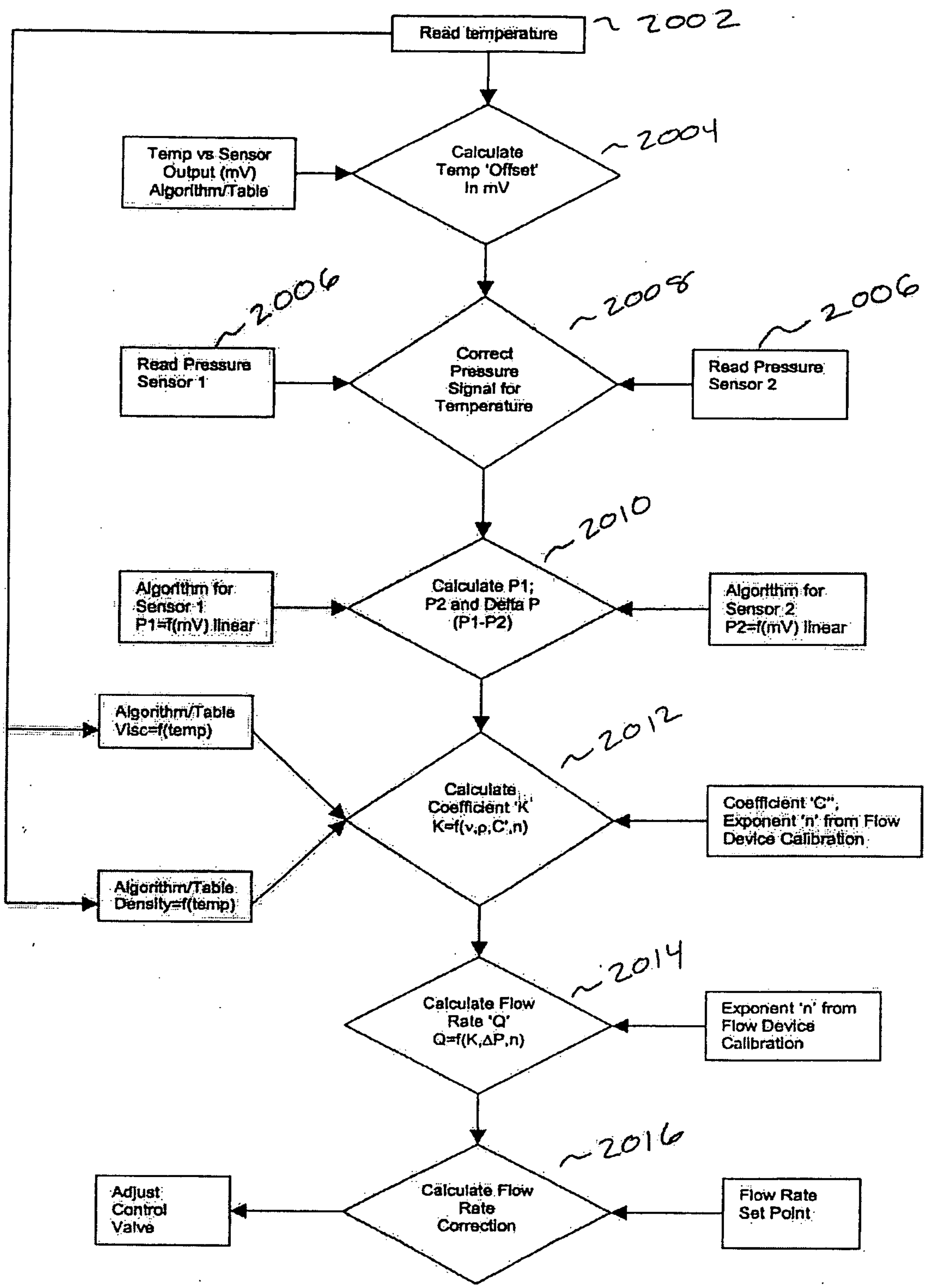


FIG 20

10/521697

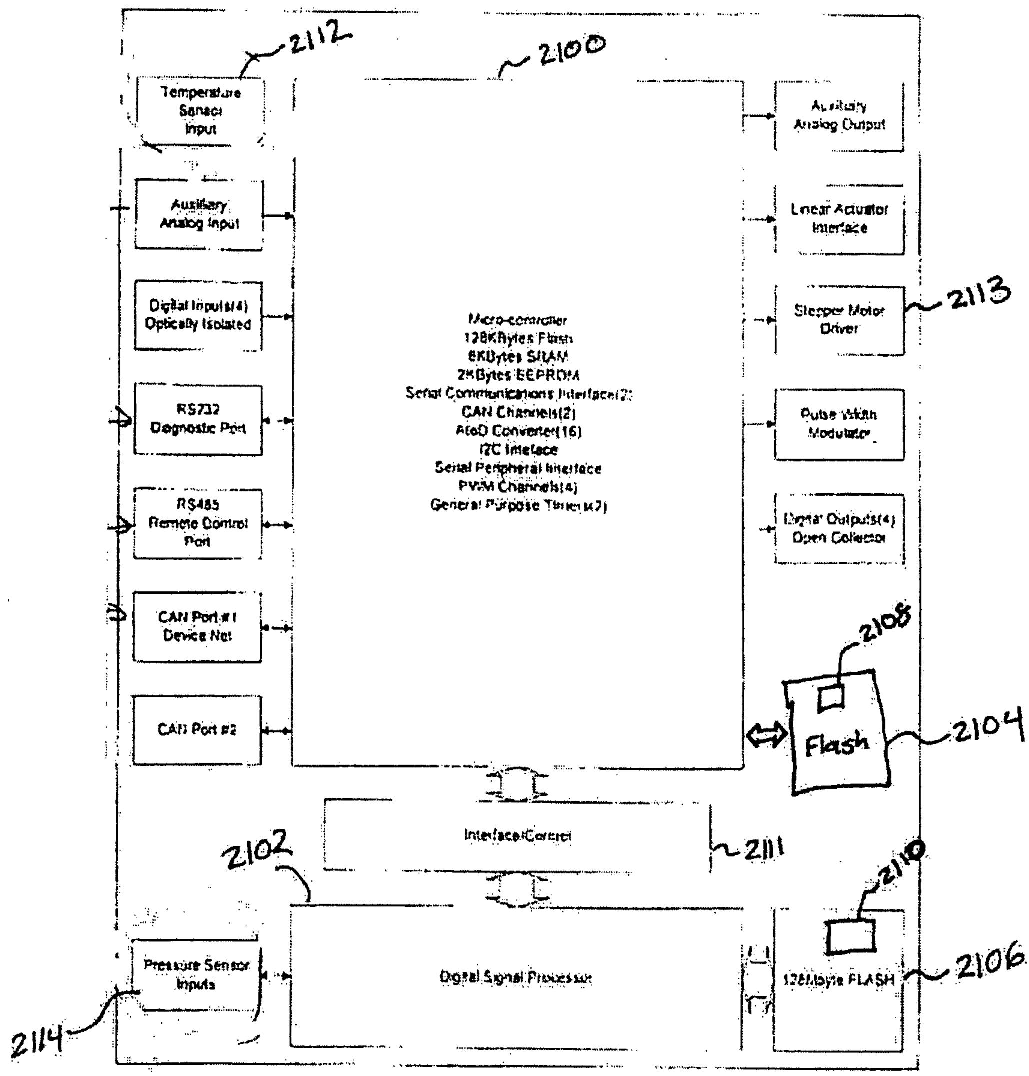


Figure 21

As long as the fluid speed is sufficiently subsonic ($V <$ mach 0.3), the incompressible Bernoulli's equation describes the flow. Applying this equation to a streamline traveling down the axis of the horizontal tube gives,

$$p_a - p_b = \Delta p = \frac{1}{2}\rho V_b^2 - \frac{1}{2}\rho V_a^2$$

From continuity, the throat velocity V_b can be substituted out of the above equation to give,

$$\Delta p = \frac{1}{2}\rho V_a^2\left[\left(\frac{A_a}{A_b}\right)^2 - 1\right]$$

Solving for the upstream velocity V_a and multiplying by the cross-sectional area A_a gives the volumetric flowrate Q,

$$Q = \sqrt{\frac{2\Delta p}{\rho}}\frac{A_a}{\sqrt{\left(\frac{A_a}{A_b}\right)^2 - 1}}$$

Ideal, inviscid fluids would obey the above equation. The small amounts of energy converted into heat within viscous boundary layers tend to lower the actual velocity of real fluids somewhat. A **discharge coefficient** C is typically introduced to account for the viscosity of fluids,

$$Q = C\sqrt{\frac{2\Delta p}{\rho}}\frac{A_a}{\sqrt{\left(\frac{A_a}{A_b}\right)^2 - 1}}$$

Figure 22

10/521697

10/521697

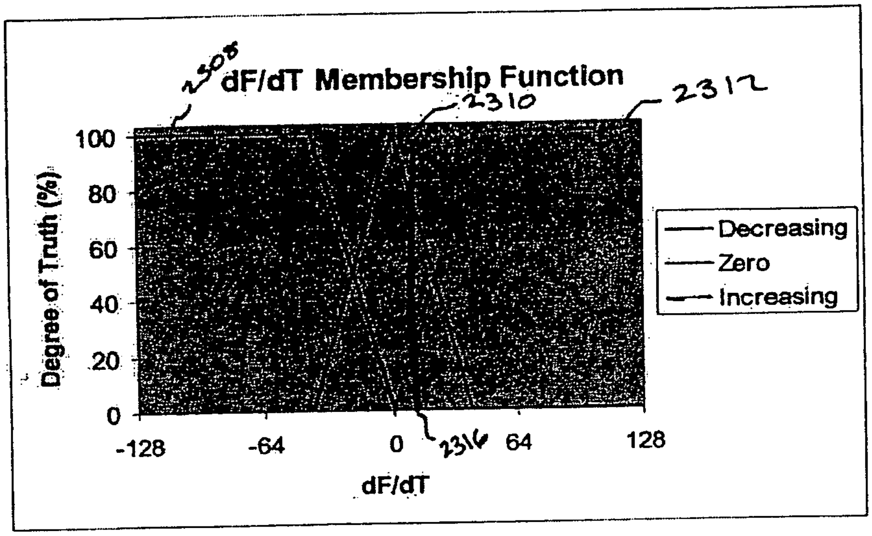


FIG 23B

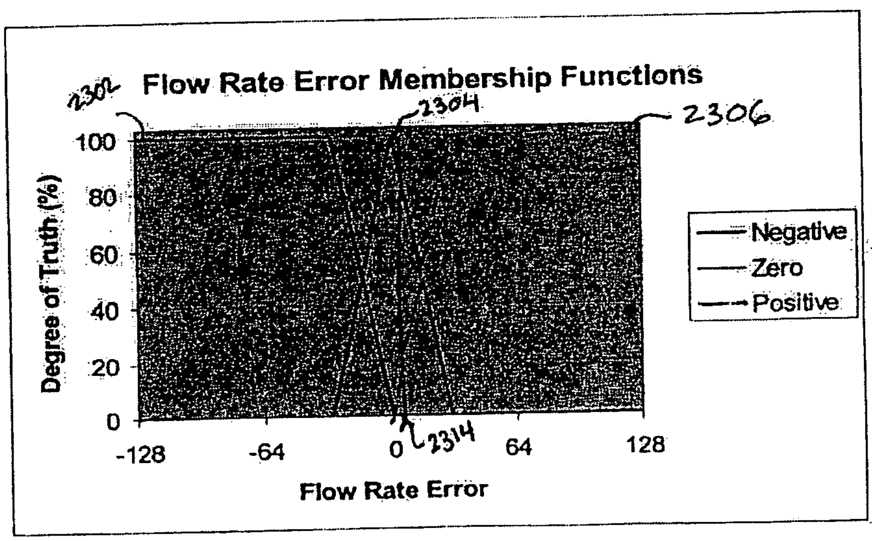


FIG 23A